



Federal Aviation Administration

Airport Technology Research & Development (ATR)



A number of visual cues around the airport help pilots and vehicles operators to maintain proper distance, alignment, and situational awareness in the airport operations area.

Airport Visual Guidance Systems Provide Important Information When Maneuvering On The Airport

Visual guidance is the information and science of ensuring safe, accurate movements in and around airport operations area using visual cues. Runway and taxiway lights, obstruction lights, signage, surface markings are some of the cues that pilots and ground vehicle operators rely on for navigation during aircraft taxiing, takeoff, landing, and anyone maneuvering on the airport surface.

Two types of activities make up a majority of the FAA's Visual Guidance Research Program: First, is the identification of opportunities for improvement with existing airport lighting, signage, and surface painted markings that may cause confusion, lack conspicuity, or potentially contribute to a pilot or ground vehicle operator causing a runway incursion. Field Testing and evaluation, along with data analysis and stakeholder collaboration, are used to identify and limit factors that inhibit a pilot or vehicle operator's situational awareness.

Second, our research continues to evaluate new visual guidance concepts and technologies to improve the safety and efficiency of aircraft and ground vehicle operations.

AIRPORT LIGHTING,
SURFACE PAINTED MARKINGS,
AND SIGNAGE ARE SOME OF
THE MOST IMPORTANT CUES
THAT PILOTS AND VEHICLE
OPERATORS RELY ON TO
ENSURE SAFE MOVEMENT ON
THE AIRPORT SURFACE.

This Research Program also includes the development of performance specifications used in numerous Advisory Circulars and other FAA guidance documents. In particular, the advent of light emitting diode (LED) fixtures in the early 2000s prompted numerous studies supporting the transition from incandescent lighting to an entirely new generation of visual

cues for pilots and ground vehicle operators.

Four areas consisting of the most important cues aiding in pilot situational awareness make up the FAA Office of Airport's Visual Guidance Research Program: Airport Lighting and Infrastructure; Airport Surface Markings, Signs, and Vehicle Operations; Lighting Innovations & Special Projects; and National Airspace System (NAS) Visual Aids. Advancements in all four categories ensure that the NAS continues to operate as safely and reliably as possible, at all times and in all types of weather.



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FAA Office of Airport's Visual Guidance Research Program

Airport Lighting and Infrastructure:

This area includes research and development on airport lighting fixture types, airport lighting engineering standards, and the infrastructure needed to operate and support lighting systems on an airport. This includes general airport lighting, runway lighting, and taxiway lighting. Specific research includes:

- Light fixtures
- Light Emitting Diode (LED) integration
- Frangible connections
- Airport electrical infrastructure
- LEDs with infrared emitters
- Solar powered lighting
- Heliport lighting
- Obstruction lighting



Instrumented In-Pavement Light Can

Airport Surface Markings, Signs, and Vehicle Operations:

Airport surface markings and signs provide visual cues to pilots and vehicle operators to enhance safe and efficient movement on an airport. This area includes research and development on airport pavement markings and sign systems that are useful to pilots and vehicle operators during takeoff, landing, taxiing, and navigating on the airport to reduce runway incursions. This includes a variety of different types of surface markings, applications, colors, conspicuity, as well as the painting, marking, and lighting of ground vehicles that operate in the airport operations area. Specific research includes:

- Airport signs
- Surface markings
- Runway incursion mitigation
- Vehicle operations with lighting and markings

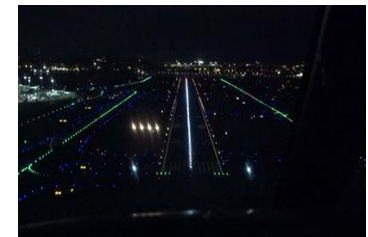


Airport Surface Markings

Lighting Innovations & Special Projects:

This area includes research and development on new visual guidance ideas and concepts, photometric laboratory testing, and special projects, such as mitigation of wrong surface landing events. The FAA operates a photometric laboratory used for initial assessments of lighting fixtures for photometry and colorimetry prior to lab certification. The FAA also has a Cooperative Agreement with Rensselaer Polytechnic Institute's Lighting Research Center for a variety of research topics such as LEDs, photometrics, technology scouting, human factors. Specific research areas include, but are not limited to:

- New airport lighting concepts
- FAA Photometric Laboratory
- Special Project - Mitigation of potential wrong surface landing events
- Cooperative Agreement - Rensselaer Polytechnic Institute's Lighting Research Center



Airport Lighting

National Airspace System (NAS) Visual Aids:

The NAS Visual Aids research is conducted in coordination with the FAA Lighting Systems Office and includes Approach Lighting Systems (ALS) such as Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR), LED lamps with Infrared (IR), visual NAVAIDS Vertical Glide Slope Indicators (VGSI) such as a Precision Approach Path Indicator (PAPI), Runway End Identifier Lights (REIL), and other navigational systems pilots use to safely land aircraft. FAA researchers also assist with PAPI installation and siting criteria, obstruction identification, and obstruction solutions such as "baffles." Additionally, the FAA operates an experimental MALSR for test and evaluation purposes at Atlantic City International Airport's Runway 4. Specific research areas include, but are not limited to:

- Approach lighting systems, e.g., MALSR
- Visual NAVAIDS, e.g., PAPI
- LED lamps with infrared emitters
- Atlantic City International Airport Runway 4 Experimental MAS



LED Precision Approach Path Indicator